

The exotic pyraloid moth *Diplopseustis perieresalis* (Walker) expanding in the West Palaearctic Region (Crambidae: Spilomelinae)

WOLFGANG SPEIDEL¹, ERIK J. VAN NIEUKERKEN², MARTIN R. HONEY³ & SJAAK (J. C.) KOSTER²

¹ Museum Witt, Tengstrasse 33, 80796 München, Germany; e-mail: speidel-wolfgang@web.de

² National Museum of Natural History Naturalis, PO Box 9517, 2300 RA Leiden, Netherlands; e-mail: nieukerken@naturalis.nl

³ Natural History Museum, Cromwell Road, London SW7 5BD, UK; e-mail: M.Honey@nhm.ac.uk

Abstract. The widespread Oriental and Australian pyraloid moth *Diplopseustis perieresalis* (Walker, 1859), recently found once on the Scilly Isles, U.K., is here recorded for the first time from the Canary Islands, mainland Spain, the Balearic Islands and Portugal. Furthermore, we report an adventive record for The Netherlands. The species is probably established on the Canary Islands of La Gomera and Tenerife, where it may have been accidentally introduced by man, while records from the Iberian Peninsula and Balearic Islands probably refer to adventive or migrating specimens. Species of *Carex* are possibly the larval host plant.

Zusammenfassung. Die weit verbreitete Orientalische und Australische Zünsler-Art *Diplopseustis perieresalis* (Walker, 1859), die erst kürzlich einmal auf den Scilly Inseln, Großbritannien gefunden wurde, wird hier erstmals von den Kanarischen Inseln, dem spanischen Festland, den Balearen und Portugal gemeldet. Weiterhin melden wir einen Fund von den Niederlanden. Die Art ist wahrscheinlich auf den Kanarischen Inseln La Gomera und Teneriffa bodenständig geworden, wohin sie wahrscheinlich zufällig durch den Menschen eingeschleppt wurde; die anderen Meldungen beziehen sich wahrscheinlich auf verschleppte oder verdriftete Tiere. *Carex*-Arten sind möglicherweise die Futterpflanze der Raupe.

Key words. Areal expansion, Distribution, Oriental region, Palaearctic region, Canary Islands, Spain, Balearic Islands, Portugal, Netherlands.

Introduction

During the last few decades in Europe many Lepidoptera have undergone range expansions, often attributed to global warming (Parmesan *et al.* 1999). In addition, several species from other continents have been found in Europe, in most cases probably aided by man, and some of these have successfully established populations. These species tend to show an explosive increase in their distribution area and can become harmful to ornamental plants and trees. Examples are the horse chestnut leafminer (*Cameraria ohridella* Deschka & Dimič, 1986) (reviewed by Hellrigl 2001), the castniid palm borer, *Paysandisia archon* (Burmeister, 1880) (Sarto i Monteys 2002) and the geranium bronze, *Cacyreus marshalli* (Butler, 1898) (Sarto i Monteys 1992). These three species have become a real problem in Europe and represent an economic threat in the order of magnitude of millions of Euros annually. In this light, it is important to monitor and report the arrival of new species in Europe.

The exotic pyraloid moth *Diplopseustis perieresalis* (Walker, 1859) was recorded in Europe for the first time from the Scilly Isles (Mackay & Fray 2002).

The discovery of an unknown pyraloid moth in a flower shop in The Netherlands was the immediate reason for writing this paper: the senior author recognised it as

D. perieresalis, a species for which he also had a few, unpublished, recent records from the Western Palaearctic region. We report here on these findings and summarise our knowledge of this species, in order for it to become known and recognised and in order that its spread can be monitored.

Methods

Photographs were taken by E. van Nieukerken with an AxioVision camera attached to a Zeiss Axioskop H for the genitalia or a Zeiss Stemi SV11 for the moths. The map was prepared with *DMap 7.0* (Morton 2000) and edited with *Adobe Illustrator*.

Diploseustis perieresalis (Walker, 1859)

Figs 1–6

Ambia perieresalis Walker, 1859: 958. Type locality: Borneo, Sarawak (Oxford University Museum of Natural History).

Cymoriza minima Butler, 1881: 684. Type locality: [Taiwan] Formosa, Takow (Natural History Museum, London) (synonymised by Hampson 1896: 489).

Sufetula nana Warren, 1896: 225. Type locality: India, Bombay (Natural History Museum, London) (synonymised by Hampson 1896: 489).

Diploseustis minima; Meyrick 1884: 285 [new genus, recombination].

Diploseustis perieresalis; Hampson 1896: 489 [revision]; Inoue 1982: 230 [Japan]; Dugdale 1988: 143 [New Zealand]; Heppner & Inoue 1992: 83 [Taiwan]; Patrick 1994: 100 [Antipodes, Chatham island, biology]; Shaffer et al. 1996: 190 [Australia]; Hong Kong Lepidopterist's Society 2005: online catalogue [Hong Kong].

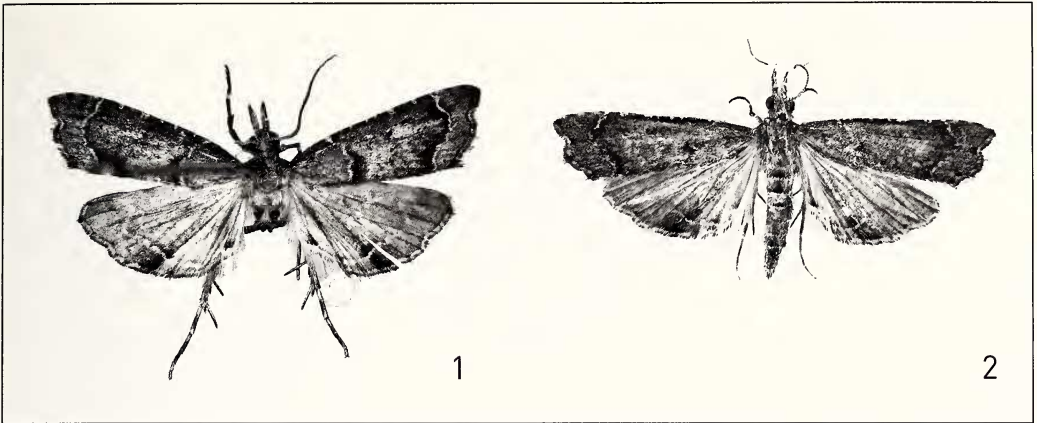
Diploseustis perieralis [sic]; Dugdale 1973: 202 [Kermadec Islands].

Diploseustis periersalis [sic]; Mackay & Fray 2002: 26 [first published record West Palaearctic].

Diploseustis [sic] *perieresalis*; Evenhuis 2006: 6 [Fiji].

Material. West Palaearctic: **The Netherlands:** 1♂, [prov. Gelderland], 's Heerenberg, in flower shop, 9.ix.2003, C. Naves, genitalia slide JCK5777 (coll. C. Naves). – **Portugal:** 1♀, Algarve/Luz, near Lagos, 12.–22.x.2000, G. Achenbach, genitalia slide Schmitz (coll. W. Schmitz). – **Spain:** 1♀, Prov. Alicante, Parcent, 500 m, 29.xi.2003, H. Rietz (coll. H. Rietz); 1♂, Tarragona, El Torn, L'Hospitalet, 8.vii.2003, N. M. Hall (coll. N. M. Hall). Balearic Islands: 1♀, Mallorca, s'Albufera, Sa Roca, 26.iv.2006, M. R. Honey (coll. M. R. Honey). Canary Islands: 1♀, La Gomera, Loma de Tecina, at light, 24.ii.2001, A. Werno, genitalia slide JCK6201 (coll. W. Speidel); 1♂, La Gomera, Guarimiar, at light, 1.iii.2001, A. Werno (coll. A. Werno); 1♀, Tenerife, Puerto de la Cruz, at light, 2.iii.2001, A. Werno (coll. A. Werno). – Other regions: **China:** 1♂, West Tien Mu Shan, Prov. Chekiang [Zhejiang], 9.ix.1932, H. Höne; genitalia slide Speidel 652 (Zoological Research Institute and Museum A. Koenig, Bonn). – **New Zealand:** 1♂, Christchurch, 26.iii.1882, Meyrick coll., genitalia slide JCK6144 (National Museum of Natural History Naturalis, Leiden).

Identification. A Canary Island specimen was compared by the senior author with the *Diploseustis* species in the Natural History Museum collection in London, in order to exclude the possibility that an Afrotropical species was involved. The external appearance of *D. perieresalis* proved to be sufficiently distinctive to enable exclusion of other related species, and no identical Afrotropical species could be found. Later, specimens from China and from New Zealand were carefully compared and found to be identical with the West-Palaearctic specimens; the male genitalia were also in agreement (but see below).

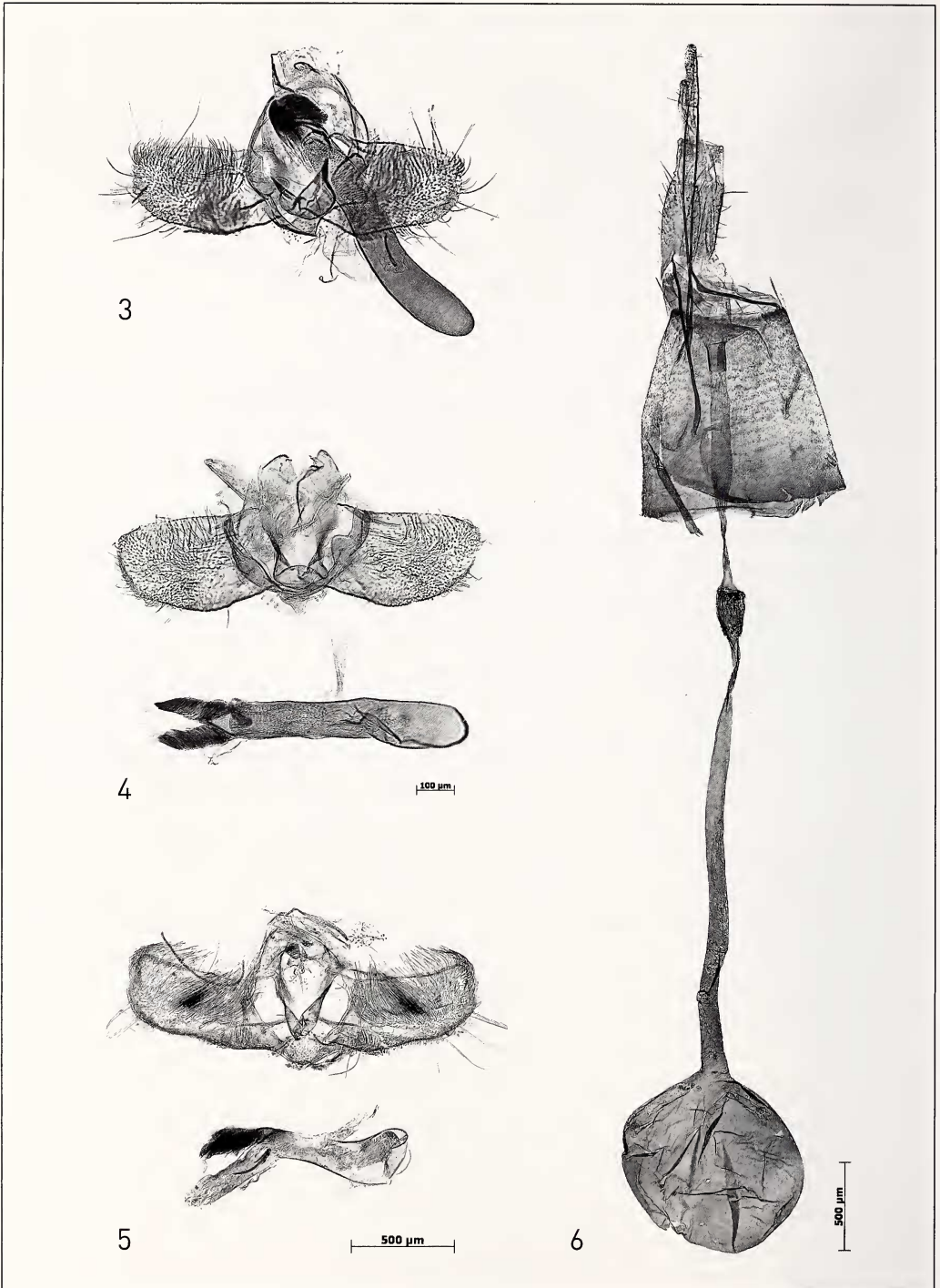


Figs 1–2. *Diplopseustis perieresalis*, adult habitus. **1.** Male: Netherlands, 's Heerenberg. **2.** Female: Spain, Mallorca.

Recognition. *Diplopseustis perieresalis* superficially (Figs 1–2) resembles some European Pyralidae, Pyralinae, e.g. some *Pyralis* species (which are easily separated by the separate Sc+R₁ in the hindwing, which is stalked with Rs in *Diplopseustis*), or melanistic *Endotricha flammealis* ([Denis & Schiffermüller], 1775), from which it is easily separated by the combination of long porrect palpi, the position of the dark marking on the hindwing, and the sinuous forewing termen. The male genitalia (Figs. 3–5) have a strongly reduced gnathos, a characteristic of the Pyraustinae and Spilomelinae, and the aedeagus (= phallus) is characterised by a pair of hairy lobes and a single strong cornutus. The female genitalia (Fig. 6) lack a rhomboid signum, a condition that refers the species to the Spilomelinae; otherwise the corpus bursae is globular, the ductus bursae is elongate, and the ovipositor has long apophyses.

The photographs of the male genitalia show some slight differences, notably in some details of the valva, the Dutch and New Zealand specimens being most similar. With the low number of slides studied we cannot decide whether this is due to intraspecific variation alone. This observation, however, stresses the need for a systematic revision of the genus *Diplopseustis*.

Distribution. *Diplopseustis perieresalis* as currently defined is widely distributed in the Oriental and Australian regions and in the eastern parts of the Palearctic region; there being records from Japan, Taiwan, Hong Kong, coast of mainland China (Zhejiang, Shanghai), India, Malaysia (Borneo, Sarawak – the type locality), Australia, Fiji, New Zealand and several of its off-shore islands (Antipodes, Chathams, Kermadec). Records from India, Assam, refer to other closely related species that were once considered to be synonyms (see below). For a map showing the known records in the Western Palearctic, see Fig. 7.



Figs 3–6. *Diploseustis perieresalis*, male (3–5) and female (6) genitalia. **3.** Netherlands, 's Heerenberg, genitalia slide JCK5777; aedeagus not separated. **4.** New Zealand, Christchurch, genitalia slide JCK6144; aedeagus in ventral view. **5.** China: West Tien Mu Shan, genitalia slide WS652; aedeagus in lateral view. **6.** Canary Islands, La Gomera, Loma de Tecina, genitalia slide JCK6201.

Life history. Not much is known about the life history. Meyrick (1884: 285), when writing about adult *D. minima*, stated “frequenting rushes in damp places.” There are no direct references to the larvae of this species but Patrick (1994) provides evidence that, on the Antipodes at least, it is very likely that the species feeds on *Carex secta* Boott., a tussock forming species that is widely distributed in New Zealand. Interestingly, this is one of the more widely available cultivated species of *Carex*, as a search of Google quickly shows. The wetland site of the Mallorcan specimen, described below, fits with this picture. Adults have been found in most months of the year, the Canarian specimens are from February-March, the Mallorcan specimen from April, the Tarragona specimen in July, and the other Western Palaearctic records from September to November.

Systematics. The genus *Diploseustis* Meyrick, 1884 contains a number of species. The *Global Lepidoptera Names Index* (Beccaloni et al. 2005) cites eight names (one of which is a manuscript name!), of which two are regarded as synonyms of *perieresalis* (see above), resulting in five valid species, from Africa, India, New Guinea, and Australia. A further name (*eucosmeta* Turner, 1939) is regarded as a synonym of one of the Australian species (*prophetica* Meyrick, 1887) (Shaffer et al. 1996). Related genera may well prove to contain more true *Diploseustis* species that are misplaced at present and we know of a few additional, unnamed, species from Southeast Asia, though the number of species within the genus will probably remain low.

Hampson (1896) synonymised four species with *perieresalis* but we consider that those described from Assam and Khasi Hills (*D. constellata* Warren, 1896 and *D. pallidalis* Warren, 1896), should be regarded as different species. The genus was for a long time regarded as belonging to the Pylalinae but its genitalia clearly place it in the Spilomelinae. As to the rank of the family group name Spilomelinae, we follow Nuss et al. (2004), the most recent list of European Lepidoptera. Previously it was often cited as the tribe Spilomelini within the Pyraustinae (e.g., Shaffer et al. 1996).

Discussion. The first specimen collected in the West Palaearctic was taken in October 2000 in Portugal. In the early spring of 2001 several specimens were taken in the Canary Islands and on 19 October of that year, the Scilly Isles specimen was found. The Spanish and Dutch specimens were found in 2003 and the specimen on Mallorca was found in April 2006.

The widespread occurrence on the Canary Islands suggests that *Diploseustis perieresalis* was established there by the year 2000, or earlier. It is uncertain whether the specimens along the Portuguese and Spanish coasts belong to resident populations. The specimen found on the Scilly Isles was considered to be an adventive, possibly imported with plants into the Abbey gardens (Mackay & Fray 2002), but the geographic position of these islands (Figure 7), and the fact that it was collected together with several migrant species, make it more likely that it too arrived there by natural dispersal from the Canary Islands. The record from the Netherlands flower shop, however, is almost certainly adventive: the fresh condition of the specimen indicating that it had just emerged, brought in as a caterpillar or pupa with imported plant material. There is a frequent trade of plants

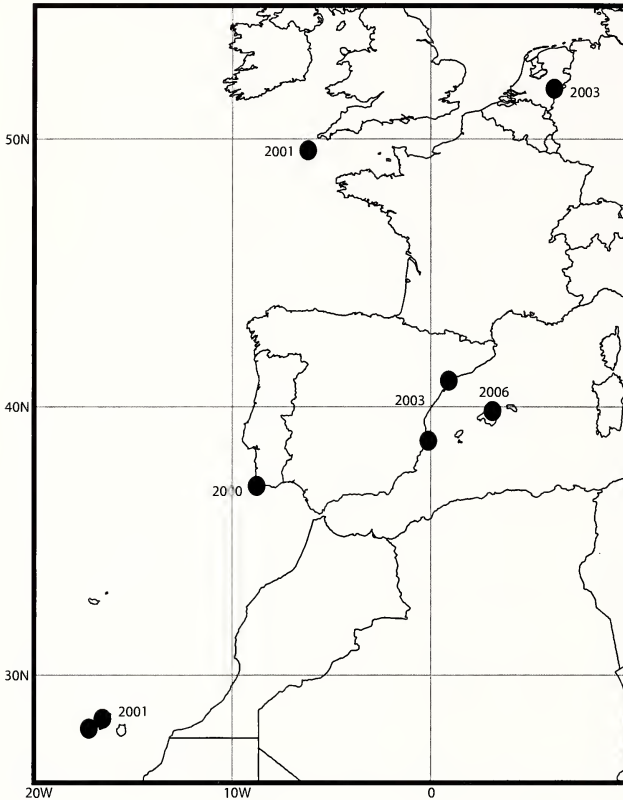


Fig. 7. *Diplostepus perieresalis*, records in West Palearctic, with years indicated.

between the Canary Islands, Spain, and the Netherlands. The Mallorcan specimen was taken at a lighted window in the middle of s'Albufera, a wetland reserve of over 1700 ha. The habitat adjacent to the capture site comprises over 500 hectares of dense *Cladium mariscus* reed bed interspersed with *Phragmites australis*. *Arundo donax* borders some of the tracks fringing the reed beds and the tracks also support several patches of *Carex* (mainly *C. extensa* and *C. distans*, with some *C. otrubae*). The probability of it being an adventive there is highly unlikely.

How an oriental insect could have reached the Canary Islands is open to debate. Two possibilities deserve further discussion and research. The first, transport aided by man,

seems at present to provide the best explanation. The trade of plants between Australia, New Zealand, and Japan, all home to this species, and the Canary Islands is probably frequent. If *Carex* is indeed the hostplant, then it could easily become established, since *Carex* species occur almost everywhere. Moreover, the New Zealand *Carex secta* is a popular garden plant and transport of larvae with imported plants of this species is a distinct possibility (a similar situation occurred with the introduction of *C. marshalli* to Europe from South Africa with garden *Pelargonium*). The second possibility is that the species reached the Canary Islands on its own. It has a very wide distribution and, apparently, a strong dispersal power. It is quite possible that the presence of *D. perieresalis* somewhere between India and West Africa has been overlooked. We hope that this paper will provoke further search for the species in both private and museum collections and the field, hopefully bridging some of the current gaps in its distribution.

It is open to speculation as to whether the species can establish permanent populations in the more northern countries and whether we can expect further expansion or, indeed, damage to garden plants. If the larval host plant is correct, it cannot be the limiting factor for range expansion.

Acknowledgements

We are grateful to G. Achenbach (Wermelskirchen, Germany), Norman M. Hall (Reading, Berkshire, U.K.), Charles Naves (Drempt, the Netherlands), H. Rietz (Schwarzenbeck near Lauenburg, Germany), Willibald Schmitz (Bergisch-Gladbach, Germany), and Andreas Werno (Landsweiler-Reden, Germany) for the loan of material and for permission to publish their data. Michael Shaffer (Natural History Museum, London, U.K.) provided important information on taxonomy and nomenclature of this species. M. R. Honey is grateful to the Balearic Government's Conselleria de Medi Ambient and its S'Albufera Parc Director, Maties Rebassa, for providing access to laboratory facilities and for permission to conduct studies in the Parc and also thanks Nick Riddiford (Schoolton, Fair Isle, U. K.), the volunteers and other participants in The Albufera Initiative for Biodiversity for their enthusiastic help in collecting and sorting material. Matthias Nuss and Bernard Landry are acknowledged for their critical remarks on the manuscript.

References

- Beccaloni, G., M. Scoble, G. Robinson & B. Pitkin 2005. The global Lepidoptera names index. Natural History Museum. – <http://www.nhm.ac.uk/research-curation/projects/lepindex/index.html> [Accessed 15 June 2006.]
- Butler, A. G. 1881. On a second collection of Lepidoptera made in Formosa by H. E. Hobson, Esq. – Proceedings of the Zoological Society of London **1880**: 666–691.
- Dugdale, J. S. 1973. A note on Kermadec Islands Lepidoptera. – New Zealand Entomologist **5** (2): 197–203.
- Dugdale, J. S. 1988. Lepidoptera: annotated catalogue, and keys to family-group taxa. – Fauna of New Zealand **14**: 1–262.
- Evenhuis, N. L. 2006. Checklist of Fijian Lepidoptera. – Bishop Museum Technical Report **35** (13): 1–46. Available at: <http://hbs.bishopmuseum.org/fiji/checklists/lepidoptera.html> [Accessed 15 June 2006.]
- Hampson, G. F. 1896. On the classification of three subfamilies of moths of the family Pyralidae: the Epipaschiinae, Endotrichinae, and Pyralinae. – Transactions of the Entomological Society of London **1896** (4): 451–550.
- Hellrigl, K. 2001. Neue Erkenntnisse und Untersuchungen ueber die Rosskastanien-Miniermotte *Cameraria ohridella* Deschka & Dimic, 1986 (Lepidoptera, Gracillariidae). – Gredleriana **1**: 9–81.
- Hepner, J. B. & H. Inoue 1992. Lepidoptera of Taiwan. Volume 1. Part 2: Checklist. – Scientific Publishers Inc. Gainesville, Florida. xlix, 76 pp.
- Hong Kong Lepidopterists' Society 2005. Hong Kong moths scientific [sic] name list. Hong Kong Lepidopterists' Society. – <http://www.hkls.org/mot-list.html> [Accessed 12 June 2006.]
- Inoue, H. 1982. Pyralidae. Pp. 223–254, pls 36–48, 228, 296, 298–314. – In: H. Inoue, S. Sugi, H. Kuroko, S. Moriuti & A. Kawabe (eds.), Moths of Japan 2. Plates and synonymic catalogue. **2**. – Kodansha, Tokyo.
- Mackay, A. & R. Fray 2002. *Diploseustis periersalis* [sic] (Walker) on Tresco, Isles of Scilly – the first record for Britain and the western Palearctic region. – Atropos **16**: 26.
- Meyrick, E. 1884. On the classification of the Australian Pyralidina. – Transactions of the Entomological Society of London **1884**: 277–350.
- Morton, A. 2000. DMAP for Windows. Version 7.0e. – Alan Morton, Winkfield, Windsor, Berkshire. Computer programme. <http://www.dmap.co.uk/welcome.htm>.
- Nuss, M., W. Speidel & A. Segerer 2004. Fauna Europaea: Crambidae, Pyralidae, Thyrididae. – In: O. Karsholt & E. J. van Nieukerken (eds.), Lepidoptera, Moths. Fauna Europaea version 1.1., Copenhagen, Amsterdam, Paris. Available from <http://www.faunaeur.org/> [Accessed 30 June 2006.]
- Parmesan, C., N. Ryrholm, C. Stefanescu, J. K. Hill, C. D. Thomas, H. Descimon, B. Huntley, L. Kaila, J. Kullberg, T. Tammaru, W. J. Tennent, J. A. Thomas & M. Warren 1999. Poleward shifts in geographical ranges of butterfly species associated with regional warming. – Nature **399** (6736): 579–583.
- Patrick, B. 1994. Antipodes Island Lepidoptera. – Journal of the Royal Society of New Zealand **24** (1): 91–116.
- Sarto i Monteys, V. 1992. Spread of the Southern African Lycaenid butterfly, *Cacyreus marshalli* Butler, 1898, (LEP: Lycaenidae) in the Balearic Archipelago (Spain) and considerations on its likely introduction to continental Europe. – Journal of Research on the Lepidoptera **31** (1–2): 24–34.

- Sarto i Monteys, V. 2002. The discovery, description and taxonomy of *Paysandisia archon* (Burmeister, 1880), a castniid species recently found in southwestern Europe (Castniidae). – *Nota lepidopterologica* **25** (1): 3–16.
- Shaffer, M., E. S. Nielsen & M. Horak 1996. Pyralidae. Pp. 164–199. – *In*: E. S. Nielsen, E. D. Edwards & T. V. Rangsi (eds.), Checklist of the Lepidoptera of Australia. Monographs on Australian Lepidoptera **4**. CSIRO, Canberra.
- Walker, F. 1859. Pyralides. – List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, London **19**: 799–1036.
- Warren, W. 1896. New species of Pyralidae &c. from the Khasia Hills. – *Annals and Magazine of Natural History* (ser. 6) **18** (105): 214–232.